The decade of the fifties in the *Journal*

The article entitled, "The Surgical Treatment of Patent Ductus Arteriosus" (Vol 14, No 5 May-June 1955) reported the first attempt in Hawaii to treat congenital heart disease; it was a prelude to the routine use of cardiopulmonary bypass and operations on the coronary arteries. These valuable procedures are now available in at least 4 Honolulu hospitals. This was the high point of the 1950s.

The extreme presentation of a patent ductus arteriosus, the aortic-pulmonary window, requires cardiopulmonary bypass for safe repair. Dr John Gibbon had successfully utilized cardiopulmonary bypass to correct an atrial septal defect in 1953. (Gibbon JH Jr: Application of a mechanical heart and lung apparatus to cardiac surgery, Minnesota Med 37:171-185, 1954.) Wide application of the technique required advances in the technical aspects of the surgery, eg, perfusion apparatus and mechanical valves.

The *Hawaii Medical Journal* recognized the significance of the start of this type of surgery by publishing this report of the surgical procedure which was made safer because of the availability of the Potts clamp.

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Addendum:

However, the HMA House of Delegates voted to purchase a full page ad in the Statehood edition of the *Honolulu Advertiser*. [Interestingly, there seems to have been nothing spectacular written in the 1950s in the *Journal* that had any reference to Hawaii becoming the 50th State in August of 1959, not long after Alaska became the 49th/Ed.]

. . . report of 14 consecutive cases

The surgical treatment of patent ductus arteriosus

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The surgical treatment of the patent ductus has been developed and technically perfected in the past 15 years. The safety of the operation, when properly carried out by those familiar with the conditions found, is so well established that no one over 4 years of age and under 30 should be denied the unquestioned benefit of having the shunt closed. Recent developments in technique, notably the use of the Potts-Smith-Gibson clamp, as advocated by Conklin and Watkins[1], make many authorities feel that any patent ductus at any age should be closed, even in the absence of symptoms of cardiac embarrassment.

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Received for publication February 21, 1955.

Although reports have been published by Fishman and Silverthorn[2] of 2 individuals living to 73 and 75 years with a patent ductus, the fact remains that these patients finally died as a direct result of the presence of the lesion. Certainly the adult who has cardiac embarrassment from the presence of the ductus faces a markedly decreased life span unless something is done. It is believed by the authors that careful technique and the use of the Potts-Smith-Gibson clamp will allow the operation to be performed with a mortality no greater than that of any major-risk procedure. This risk should be only a fraction of that accompanying the untreated condition itself. One must not forget the constant threat of bacterial endarteritis, which of course ends the lives of many patients with this anomaly. When we realized that the cardiovascular system can be restored to normal by division of the ductus, the indications for conservative treatment must be carefully scrutinized.

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Differential diagnosis

The diagnosis of patent ductus arteriosus can be made with considerable accuracy on the basis of history, physical examination and fluoroscopic and electrocardiographic determinations in persons over the age of 4 years. The typical continuous roaring murmur with systolic accentuation in the second and third left interspaces, accompanied by systolic thrill, is nearly always present. At times, the diastolic element may be difficult to hear; and in children under the age of 3 there may be a very faint murmur, or no murmur at all.

Certain conditions must be borne in mind when the above-described murmur is heard. A venous hum near the left clavicle may be confusing, but compression of the neck veins should largely obliterate this sound. An arteriovenous fistula in the mediastinum or pulmonary tissues, where there is a left-to-right shunt and therefore no cyanosis, may cause difficulties; but this condition is quite rare. Occasionally rheumatic aortic insufficiency and stenosis may have a murmur simulating a patent ductus, and of course an aortic septal defect may be indistinguishable clinically even after cardiac catheterization. Interatrial septal defect may at times also be confused with a patent ductus.

The presence of cyanosis or hyperhemoglobinemia, in the absence of dehydration, should make one hesitate to make a diagnosis of pure patent ductus.

Fluoroscopic examination, with a swallow of barium to determine the course of the esophagus, is extremely valuable. The presence of a prominent pulmonary conus, with some hilar congestion and a slightly prominent left ventricle, is very helpful, as is the finding of a widened pulse pressure. We feel that the vast majority of pure patent ductus arteriosus can be diagnosed accurately with the procedures outlined above, and that cardiac catheterization is not necessary.

Treatment

According to Taussig[3], the ideal age for operation is between 4 and 6 years. Prior to the age of 4, the diagnosis simply cannot be made with any degree of certainty. Surgery is technically easier, and is carried out with a lower mortality, during the early years of childhood.

The anesthetic used on these 14 patients was intratracheal oxygen-ether, preceded by pentothal induction in the adults. This was satisfactory in all cases, and we agree with most writers that it is the anesthetic of choice. Gross[4] has given up cyclopropane as being too prone to cause cardiac arrhythmias and arrest.

These cases have all been treated in much the same way as far as the actual technique of surgery is concerned. A curved incision was made underneath the left breast, cutting the pectoral muscles and reflecting the breast and these muscles upward. Often it had to be carried below the tip of the scapula to give adequate exposure for the application of the Potts-Smith-Gibson clamp, which was used routinely on all but the first 2 patients. The approach in all the children was through the bed of the third rib; in adults, the fourth rib was removed. They were all placed in the anterolateral position; that is, approximately 45 degrees from the vertical on the table. This was felt advantageous because it allowed maximum function of the usually compressed right lung.

After injection of the vagus nerve with 1% novocaine, an incision was made overlying the aorta and the nerve with its recurrent branch visualized and retreated. Care was used not to involve the phrenic nerve in the incision or in the retraction sutures.

Adequate mobilization of the aorta is necessary so that the Potts-Smith-Gibson clamp can be applied. In order to do this, it was always necessary to ligate one and occasionally as many as 3 of the upper intercostal vessels. However, this dissection was never difficult, and as mobilization of the aorta proceeded, it was remarkable how it facilitated the dissection of the ductus, especially in its posterior portion where it tends to be adherent to the bronchus.

The near disaster that followed excessive hemorrhage in the second case has convinced us that the use of the Potts-Smith-Gibson clamp is invaluable insurance which the operator should never be without, especially on adults with attenuated and dilated aortic walls. In each case, the patent ductus was ligated and divided in the manner described by Conklin and Watkins.

The use of the clamp to occlude the ductus, while the general condition of the patient is observed to rule out any other congenital lesion, is of great value. Five or 6 minutes, while the lungs are being re-expanded, are allowed for this procedure.

A thoracotomy tube, consisting of a large Foley catheter, was routinely placed in the dependent portion of the chest prior to closing the incision. This was attached to a water seal.

Postoperatively, these patients have had no significant complications. One patient developed a subcutaneous hematoma in the incision; none of them developed pleural effusion that persisted beyond the first week; and none required aspiration. The early cases were all placed in an oxygen tent following surgery, but in the latter ones, this extensive procedure was found to be unnecessary.

Case report

Mrs EO, a 32-year-old Japanese woman, was operated upon on January 9, 1953, for a patent ductus with marked cardiac enlargement. When the area of the ductus was exposed, a pronounced dilatation of the aorta distal to the shunt was noted. During the dissection to free the ductus, a rent occurred in the dilated portion of the aorta behind and immediately adjacent to the ductus and an exsanguinating hemorrhage resulted with cardiac arrest.

The aorta was clamped distal to the left subclavian artery; cardiac massage was immediately started and rapid replacement of blood was carried out. Mobilizing and rotating the aorta caused the tear to extend further, but no further bleeding occurred, because of the proximal clamp. The rent on the posterior wall, as well as the aortic opening of the ductus, was closed with vascular sutures and the pulmonary end of the ductus was ligated.

While the ductal openings and the aortic tear were being repaired, effective blood pressure was maintained by massage of the heart. There was no contraction of the myocardium for a period of 45 minutes, but after that time a few feeble contractions were noted, and myocardial tone returned. At the end of 1 hour and 15 minutes, a regular cardiac rate of 100 was

established, with forceful, vigorous pulsations.

In spite of the long period of arrest, no cerebral damage resulted. The patient regained consciousness a few hours after surgery, was oriented, and recognized members of the family as well as her physicians. Though one would expect serious sequelae from the 1 hour and 15 minutes during which the kidneys were deprived of their blood supply, the patient passed 1700 cc of urine in the first 24 hours and she was able to concentrate satisfactorily. Almost complete flacid paralysis of both lower extremities lasted about 3 weeks, after which time strength and active control of the legs slowly returned.

Since the operation 2 years ago, the patient has had no cerebral sequelae from her cardiac arrest, but she has not completely regained the use of all muscle groups in the lower extremities. She is able to walk without assistance, but with an alteration of her gait and rather marked atrophy of her calves, and the legs tire readily.

Discussion

Table 1 gives pertinent data regarding the 15 patients we have operated upon for patent ductus arteriosus. The first 14 revealed the typical operative findings, and the ductus was successfully divided and closed. The pulmonary artery side was ligated and usually transfixed; in all cases the aortic defect was closed with 2 rows of continuous suture reinforced with interrupted sutures where needed. The last case, TI, was operated upon with a preoperative diagnosis of probable patent ductus arteriosus, though there was some doubt, due to the atypical character of the murmur. The finding of an aortic septal defect was not unexpected, therefore, and this diagnosis could not have been made in any other way with any degree of certainty.

The table shows that of the 14 successful cases, 7 were 6 years of age or younger. The remaining 7 ranged from 11 to 34 years of age. As in most series, there was a preponderance of females over males of 11 to 3. The series is too small to permit any conclusions regarding the racial incidence of the disease, but it is interesting to note that 5 of the patients were Japanese, 4 Filipino, 3 part-Hawaiian, and only 1 Caucasian. Symptoms were either absent or minimal, only the 3 oldest patients showing significant restriction of activity by dyspnea on exertion. Three of the young children showed significant retardation of development.

The physical findings were not unusual in most cases. All but 4 cases had the classical murmur. All patients had an increased pulse pressure. Some degree of cardiac enlargement was present in all but 3 of the patients and was progressive in the 2 youngest, CA and DU, who were operated upon as semi-

Table 1 — 15 consecutive cases operated upon for persistent patent ductus arteriosus by the authors, with relevant signs and symptoms and results obtained.

	Case	Age	Sex	Racial Extraction	Symptoms	Murmur	BP	Cardiac Enlargement	Post-Op Result
1.	GH	4	F	Japanese	None	Classical	100/60	Slight	No murmur
2.	CA	3	F	Part Hawn	Retarded development	Classical	100/0	Progressive gallop rhythm	No murmur
3.	YA	11	F	Filipino	None	Classical	100/40	Moderate	No murmur
4.	CP	5	F	Filipino	None	Classical	100/40	Moderate	No murmur
5.	DN	6	M	Part Hawn	Asthma	Classical	90/25	Slight	No murmur
6.	SS	5	F	Japanese	Retarded development	Pulmonary systolic & diastolic	110/60	None	No murmur
7.	DU	2-1/2	M	Filipino	Retarded development	Classical	110/40	Progressive	No murmur
8.	BJV	6	F	Caucasian	None	Pulmonary systolic grade III faint diastolic	100/40	Slight	Grade II pulmonary systolic murmur
9.	PA	12	F	Part Hawn	None	Classical	90/30	Moderate	No murmur
10.	RA	17	F	Japanese	Asthma	Classical	110/60	Moderate	No murmur
11.	AR	20	M	Filipino	None	Pulmonary systolic w/thrill	100/50	None	No murmur
12.	EO	24	F	Japanese	Dyspnea on exertion	Classical	105/10	Progressive	Grade I pulmonary systolic murmur
13.	EO	32	F	Japanese	Dyspnea on exertion	Classical	105/10	Progressive	Pulmonary grade I systolic murmur
14.	HY	34	F	Chinese	Dyspnea on	Classical	110/50	Moderate	No murmur
15.	GI	25	M	Japanese	Decompensation	Continuous roaring murmur	100/0	Progressive	Same as before exploration

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emergencies because of this. No murmurs were audible after surgery in 11 of the 14 successful cases. Three showed a pulmonary systolic murmur of Grade I or II intensity but in none was there a diastolic murmur present.

In these first 14 cases there were no deaths, and no postoperative complications with the exception of EO whose detailed case history has been given. The last case, GI, whose septal defect was not amenable to correction, has a guarded prognosis. One patient, DU, age 2-1/2 years, was found to have a coarctation of the aorta of moderate degree in addition to the patent ductus arteriosus. There was no evidence of impairment of the circulation by the coarctation and no attempt was made to correct it. It is possible that such will be necessary at a later date.

Summary

Fourteen cases of patent ductus arteriosus operated upon without a fatality have been presented. All were treated by ligation and division of the ductus.

The importance of the safety factor provided by the Potts-Smith-Gibson clamp has been discussed.

A detailed case report of one patient whose operation was complicated by excessive hemorrhage is given in detail. No cerebral or renal damage followed a prolonged period of cardiac massage and only slight permanent cord damage resulted from complete occlusion of the aorta for over 1 hour.

Addendum

Since the paper went to press 2 more cases have been successfully operated upon: a 16-year-old Filipino girl with an enlarged heart and a short ductus (2 cm), and a 4-year-old part-Hawaiian boy with a small ductus.

REFERENCES

1. Conklin WS and Watkins E Jr.: Use of the Potts-Smith-Gibson Clamp for Division of Patent Ductus Arteriosus, *J Thoracic Surg* 19:361 March 1950.
2. Fishman L and Silverthorne CM: Persistent Patent Ductus in the Aged, *Am Heart J* 41:762 May 1951.
3. Taussig HB: Clinical Progress, Diagnosis and Management of Common Malformations of the Heart, *Circulation* 6:930 Dec 1952.
4. Gross RE and Longino LA: The Patent Ductus Arteriosus, *Circulation* 3:125 Jan 1951.

RESOLUTION NO. 6
Re: ADVERTISER IN STATEHOOD EDITION

WHEREAS, Public relations for organized medicine can stand all the help it can get, and

WHEREAS, The Statehood Edition of the *Honolulu Advertiser* will contain a special section devoted to medicine and allied professions, which will reflect great credit upon organized medicine in Hawaii and will be distributed widely as permanent record in libraries and so forth, and

WHEREAS, Advertising support which is required to finance this publication has not been forthcoming from national pharmaceutical firms and others in anything like the expected amount, and

WHEREAS, The occasional purchase of advertising space in newspapers is basic to the maintenance of good press relations, and organized medicine has few opportunities to do this; therefore be it

RESOLVED, That the Hawaii Medical Association purchase a full page of advertising in the Statehood Edition of the Honolulu Advertiser.

Resolution No. 6:

Your reference committee recommends adoption of this resolution.

ACTION:

The Chairman moved adoption of this portion of the report.

Dr Nishijima asked how much such an advertisement would cost and was advised it would be in the neighborhood of $900. Dr Arnold was asked to speak on this subject. He said we had spent a lot of money for public relations but we had spent very little in the past few years. This isn't very much money as far as public relations goes, and he felt that it would be money well spent. We have very good relations with the "Advertiser." The medical profession spends very little money outside the subscription price and in spite of this, the newspaper has always been most cooperative and this was one way we could repay them.

The report was adopted.

A few of the editors that contributed to the *Journal* . . .

Lee McCaslin
Managing editor
1956-70

Doris Jasinsky MD
Assistant editor 1974-80
Managing editor 1980-85

Henry N. Yokoyama MD
News and Notes editor
1964 to present